ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 8, Issue, 12, pp. 22546-22549, December, 2017

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

EFFECT OF SODIUM AZIDE ON YIELD PARAMETERS OF WINGED BEAN [*PSOPHOCARPUS TETRAGONOLOBUS* (L.) DC.]

Sonavane A.S*

Department of Botany, Shardabai Pawar Mahila Mahavidyalaya, Shardanagar, Tal. Baramati, Dist. Pune (M.S.) India- 413115

DOI: http://dx.doi.org/10.24327/ijrsr.2017.0812.1287

ARTICLE INFO

Article History:

Received 10th September, 2017
Received in revised form 14th October, 2017
Accepted 08th November, 2017
Published online 28th December, 2017

Key Words:

Sodium azide, M_2 and M_3 generation, Winged bean, Mutagenic effects.

ABSTRACT

The mutagenic effects of different concentrations of sodium azide (0.01%, 0.02% and 0.03%) on winged bean (*Psophocarpus tetragonolobus* (L.) DC.) varieties II-EC-178313 and 2I-EC-38825 were investigated. The characters studied include ; days to flowering, days to maturity, plant height, number of pods per plant, number of seeds per plant and hundred seed weight in M_2 and M_3 generation. Both negative and positive shifts in mean values were recorded as a result of the chemical treatment. The results indicate the possibilities of evolving higher yield variants through proper selection. Thus economically important characters like days to maturity, number of pods per plant, number of seeds per plant and hundred seed weight in M_3 generation offer scope for selection and improvement.

INTRODUCTION

Pulses being rich in quality protein, minerals and vitamins are inseparable ingredient of the diet of majority of Indian population, (Siag *et al*., 2005). Pulses also occupy an important position in world agriculture because of their high protein content, several essential amino acids and their capacity for fixing atmospheric nitrogen. Winged bean (*Psophocarpus tetragonolobus* (L.) DC.) also known as Goa bean, four angled bean, Manila bean etc. belongs to fabaceae family. It is mainly cultivated in Papua New Guinea and Southeast Asia. Winged bean seeds are excellent source of protein and edible oil. With the realization that this crop could be as important as a soybean, particularly in the humid and tropical regions. Due to the extraordinary potentials of winged bean as a highly productive and nutritive food, feed and forage crop many developing nations like the Philippines, Papua New Guinea and Sri Lanka have already designated it as the priority crop, (NAS, 1981). The added attribute of winged bean is that virtually all parts of the plant are edible and immensely nutritious which can comprise a good industrial raw material. Its amino acid profile is similar to that of soybean, (Claydon, 1979). The seeds are similar in composition to soybean averaging 20% edible oil with a good proportion of polyunsaturated fatty acids, (Haq, 1982).

Winged bean is a self pollinating crop and possesses limited variability. Consequently, the extent to which winged bean varieties or cultivars may be improved through conventional breeding method is limited. Though it possesses several positive attributes, unfortunately it is neglected all over the world due to presence of antinutritional factors, long duration and twining nature of crop and absence of market demands. To overcome this problem, mutation breeding supplement conventional plant breeding as a source of increasing variability and could confer specific improvement without significantly altering its acceptable phenotype. The successful utilization of sodium azide (SA) to generate genetic variability in plant breeding has been reported in groundnut, (Mensah and Obadoni, 2007), barley, (Kleinhofs and Sander, 1975) and other crops, (Routaray *et al*., 1995). It has been demonstrated by many workers that genetic variability for several desired characters can be induced successfully through mutations and its practical value in plant improvement programme has been well established. The main advantage of mutation breeding is the possibility of improving one or two characters without changing the rest of the genotype. Thus the present study was undertaken to investigate the mutagenic effects of sodium azide as a means of increasing the variability within the cultivars and hence improve its nutritional value and productivity.

Corresponding author:* **Sonavane A.S
Department of Botany, Shardabai Pawar Mahila Mahavidyalaya, Shardanagar, Tal. Baramati, Dist. Pune (M.S.) India- 413115

MATERIALS AND METHODS

The experimental plant material selected for the present investigation comprised two varieties or cultivars of winged bean (*Psophocarpus tetragonolobus* (L.) DC.) namely, II-EC-178313 and 2I-EC-38825. Germplasm of these two cultivars was procured from the National Bureau of Plant Genetic Resources (NBPGR), Regional Station Akola (M.S.) India.

MUTAGEN USED

The chemical mutagen like sodium azide (SA) manufactured by Sigma chemical Company Ltd. U.S.A. was used in the present investigation.

Details of Mutagenic Treatments

Healthy and uniform seeds of two winged bean varieties such as II-EC-178313 and 2I-EC-38825 were surface sterilized with 0.1% mercuric chloride solution for about one minute and washed thoroughly with distilled water. They were presoaked in distilled water for 6 hours. Such presoaked seeds were treated with freshly prepared mutagenic solution for 6 hours.

All chemical treatments were carried out at room temperature 25 ± 2° C with intermittent shaking. The volume of the mutagenic solution used was three times as that of the seeds so as to facilitate uniform conditions. Seeds soaked in distilled water for 12 hours served as control. The different concentrations used for the chemical mutagenic treatments were 0.01%, 0.02% and 0.03%. Immediately after the completion of treatment the seeds were washed thoroughly under running tap water. Later on they were kept for post soaking in distilled water for 2 hours.

300 seeds of each treatment were sown in the field following randomized block design (RBD) with three replications along with control for raising the M_1 generation. The seeds were sown at a distance of 30 cm between the plants and 90 cm between the rows. At maturity, M_1 plants were individually harvested and sown as M_2 family. M_2 plants were harvested and sown as M_3 family.

A through statistical analysis was carried out by using standard formulae and shifts of mean were also studied to assess the amount of induced variability due to mutagenic treatments.

Table 1 Effect of sodium azide on some yield parameters of winged bean in M_2 generation

Variety	SA Conc. %	Days to flowering		Days to maturity		Plant height		No. of pods/plant		No.of Seeds/plant		Hundred Seed wt.	
		Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean
II-EC-178313	Control	105.80		142.20		278.44		22.00		139.20		33.05	
	0.01	104.33	-1.47	141.00	-1.20	267.66	-10.78	19.66	-2.34	134.15	-5.04	31.22	-1.83
	0.02	100.33	-5.47	138.00	-4.20	268.00	-10.44	20.33	-1.67	136.04	-3.16	32.28	-0.77
	0.03	99.66	-6.14	137.03	-5.17	273.08	-5.36	16.66	-5.34	132.33	-6.87	31.38	-1.67
	S.E (Mean)	0.34		0.12		0.42		0.40		0.38		0.53	
	F(Replication)	2.10		35.45		6.73		3.02		0.80		0.15	
	F(Treatment)	7.29		91.00		32.86		3.02		3.05		0.25	
	C.D. at 1 %	1.57		0.58		1.96		1.88		1.78		2.47	
	C.D. at 5%	0.94		0.35		1.18		1.13		1.07		1.49	
2I-EC-38825	Control	102.10		138.80		275.25		24.40		142.20		35.08	
	0.01	98.66	-3.44	137.00	-1.80	266.00	-9.25	25.16	-0.76	139.66	-2.54	32.07	-3.01
	0.02	97.88	-4.22	134.67	-4.13	268.67	-6.58	24.00	-0.40	136.52	-5.68	35.53	0.45
	0.03	96.66	-5.44	135.99	-2.81	271.00	-4.25	22.43	-1.97	142.48	0.28	35.73	0.65
	S.E (Mean)	0.34		0.40		0.35		0.20		0.45		0.45	
	F(Replication)	1.11		1.13		6.76		6.08		5.69		2.75	
	F(Treatment)	6.36		18.36		41.32		18.23		20.91		8.91	
	C.D. at 1 %	1.59		1.84		1.61		0.93		2.10		2.08	
	C.D. at 5%	0.96		1.11		0.97		0.56		1.26		1.25	

Table 2 Effect of sodium azide on some yield parameters of winged bean in M_3 generation

Variety	SA Conc. %	Days to flowering		Days to maturity		Plant height		No. of pods/plant		No.of Seeds/plant		Hundred Seed wt.	
		Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean	Mean	Shift in mean
II-EC-178313	Control	105.00		145.60		276.36		23.00		139.70		33.12	
	0.01	102.00	-3.00	137.32	-8.28	269.66	-6.70	19.00	-4.00	132.88	-6.82	32.82	-0.3
	0.02	103.00	-2.00	139.18	-6.42	267.78	-8.58	24.00	1.00	134.21	-5.49	33.20	0.08
	0.03	103.33	-1.67	135.52	-10.08	270.93	-5.43	18.00	-5.00	130.77	-8.93	31.03	-2.09
	S.E (Mean)	0.44		0.42		0.50		0.21		0.63		0.38	
	F(Replication)	32.00		2.43		1.30		4.00		1.01		1.19	
	F(Treatment)	1.22		15.35		8.41		31.00		16.12		1.38	
	C.D. at 1 %	2.04		1.97		2.33		0.96		2.89		1.77	
	C.D. at 5%	1.25		1.19		1.40		0.58		1.75		1.07	
2I-EC-38825	Control	102.30		139.90		274.75		23.70		142.00		35.11	
	0.01	97.00	-5.30	126.10	-13.80	273.27	-1.48	24.66	0.96	139.81	-2.19	32.63	-2.48
	0.02	98.21	-4.09	133.82	-6.08	272.16	-2.59	23.33	-0.37	136.41	-5.59	36.36	1.25
	0.03	99.66	-2.64	136.61	-3.39	271.4	-3.35	22.66	-1.04	143.73	1.73	35.80	0.69
	S.E (Mean)	0.48		1.43		0.50		0.40		0.85		0.33	
	F(Replication)	0.61		0.01		0.45		0.86		0.56		3.69	
	F(Treatment)	2.06		1.91		5.11		6.86		2.47		4.79	

The data pertaining to M_2 and M_3 generation recorded for the different polygenic traits in both the cultivars of winged bean were presented in- Table -1 and 2.

RESULTS AND DISCUSSION

In the present investigation, different quantitative characters were studied to estimate the induced variability in M_2 and M_3 generation. Induced variability was thoroughly studied in winged bean cultivars II-EC-178313 and 2I-EC 38825 for both the M_2 and M_3 generations in regard to days to flowering, days to maturity, plant height, number of pods per plant, number of seeds per plant and hundred seed weight.

Days to Flowering

The character of days to flowering plays a significant role in altering the life cycle duration of any plant. The mutagen succeeded in inducing variability in days to flowering of plants in both the cultivars of winged bean. As compared with control majority of the treated plants showed a general tendency towards early flowering. This feature was quite evident at all the SA treatments in both, II-EC-178313 and 2I-EC-38825 varieties of winged bean. The values for days to flowering in control ranged from 105.80 to 105.00 in II-EC-178313 and 102.10 to 102.30 in 2I-EC-38825. A negative shift in mean values was observed in the varieties, II-EC-178313 and 2I-EC-38825 at 0.02% and 0.03% treatments in M_2 generation. In M_3 generation this feature was indicated at 0.01% and 0.02% treatments in variety II-EC-178313, while in variety 2I-EC-38825 it was observed at all the treatments of SA. Several researchers like (Madhava Rao, 1982) in green gram and (Panchabhaye, 1997) in sunflower reported early flowering after mutagenic treatment.

Days to Maturity

Days to maturity in control were 142.20 (II-EC-178313) and 138.80 (2I-EC-38825) in M_2 generation whereas in M_3 generation, the values were 145.60 and 139.90 in II-EC-178313 and 2I-EC-38825 respectively. Both the varieties of winged bean demonstrated a significant negative shift in mean values in M_2 and M_3 generations. The variety II-EC-178313 and 2I-EC-38825 in M_3 generation revealed a negative shift in all the treatments, indicating earliness in maturity than the control.

Plant Height

It could be found that both the mutagens succeeded in inducing variability in plant height in both the varieties of winged bean. Majority of the treated plants showed the decrease in plant height in M_2 and M_3 generations of both, II-EC-178313 and 2I-EC-38825 varieties of winged bean. All the treatments shifted the mean values towards the negative direction. The decrease in mean was statistically significant. In control the mean plant height ranged from 278.44 to 276.36 cms. in variety II-EC-178313 and from 275.25 to 274.75 cms. in variety 2I-EC-38825 IN M_2 and M_3 generations respectively. From these studies it is quite clear that the significant reduced values will be observed in M_2 and M_3 generations in both the varieties of winged bean. These results support the observations of various other workers (Micke, 1961, Chary, 1983 and Padmavathi, 1993).

Number of Pods per Plant

The effect of all the mutagenic treatments on pods per plant revealed statistically significant negative as well as positive shifts in mean values in II-EC-178313 and 2I-EC-38825 in M_2 and M_3 generations. At 0.01% concentration of SA in variety 2I-EC-38825 in M_2 and M_3 generations and 0.02% of SA in variety II-EC-178313 in M_3 generation, a significant positive shift in mean values could be recorded. This was supported by (Hakande, 1992) in winged bean, (Rayyan, 1995) in black gram and (Sagade, 2008) in urdbean.

Number of Seeds per Plant

Reduced mean values could be evidently seen at most of the treatments of SA in M_2 and M_3 generations of variety II-EC-178313 and 2I-EC-38825. Both the varieties of winged bean demonstrated a shift in mean values in positive as well as negative directions in M_2 and M_3 generations. In M_2 generation, the variety II-EC-178313 demonstrated a significantly negative in mean values at all concentrations of SA, while the variety 2I-EC-38825 demonstrated at 0.03% concentration of SA. In M_3 generation, the shift in mean was exclusively in negative direction in the variety II-EC-178313, while in variety 2I-EC-38825 number of seeds per plant exhibited a significant positive shift in mean at 0.03% concentration of SA.

Hundred Seed Weight

The treatments of SA succeeded in inducing variability regarding hundred seed weight. The data revealed shift in mean values in negative and positive directions. The hundred seed weight in control of II-EC-178313 was in the range of 33.05 to 33.12 gm. while in 2I-EC-38825 it could be noted as ranging from 35.08 to 35.11 gm. In M_2 generation the variety II-EC-178313 demonstrated a significantly negative shift in mean value at all the treatments, while in variety 2I-EC-38825 showed a significantly positive shift in mean values at 0.02% and 0.03% concentration of SA. In M_3 generation, the variety II-EC-178313 at 0.02% concentration and in variety 2I-EC-38825 at 0.02% and 0.03% showed a significantly positive shift in mean values as regards the hundred seed weight.

CONCLUSION

The results indicated the possibilities of evolving higher yield variants through proper selection. Thus, economic traits like days to maturity, number of pods per plant, number of seeds per plant and hundred seed weight in M_3 generation offer scope for selection and improvement.

Mutagenic treatments increase the genetic variability, which can be utilized for selection and improvement of plants. This aspect has been addressed by (Swaminathan, 1963) and (Scossiroli *et al*, 1966) in different plants. The mutagen SA used in the present investigation has definitely proved successful in broadening the genetic base to an appreciable extent. It is hoped that the mutagenic treatments induced polygenic variability may have further scope in winged bean improvement through its incorporation in conventional breeding.

References

1. Claydon, A. (1979): The use of legumes as sources of edible oil (with special reference to winged bean) In: Legumes in the Tropics, Kwala-Lumpur (Proc. Symp.),pp 473-477.
2. Chary, S.N. (1983): Mutagenic studies in pigeon pea (*Cajanas cajan* L. Millsp.) Ph.D. Thesis, Osmania University, Hyderabad.
3. Haq, N. (1982): Germplasm resources, breeding and genetics of the winged bean. Z.Pflanzenzucht, 88: 1-12.
4. Hakande, T.P. (1992): Cytological studies in *Psophocarpus tetragonolobus* (L.) DC. Ph.D. Thesis, Marathwada University. Aurangabad, M.S. India.
5. Kleinhofs and Sander (1975): Azide mutagenesis in barley. Third barley genetics symp. Garching. Proceedings of symp. 113-122.
6. Mensah, J.K. and Obadoni, B. (2007): Effects of sodium azide on yield parameters of groundnut (*Arachis hypogaea* L.) *African Journal of Biotechnology*. 6(6): 668-671.
7. Madhava Rao, S. (1982): Experimental mutagenesis in green gram (*Vigna radiata* (L.) Wilczek) Ph.D. Thesis, Osmania University, Hyderabad.
8. Micke, A. (1961): Comparison of effect of gamma rays and thermal neutrons on viability and growth of sweet clover *Melilotus alba* after irradiation of dry seeds. In: Effect of Ionizing Radiations on Seeds Proc. Symp. IAEA, Vienna, pp403-410.
9. National Academy of Sciences (1981): "The Winged Bean- A High Protein Crop of the Tropics". Natl. Acad. Sci. Washington. D.C. *Nayar G.G. 1978: Mutation breeding Newletter, 11:9.
10. Padmavathi, T. (1993): Mutagenic studies for the improvement of sunflower (*Helianthus annuus* L.) Ph.D. Thesis, Osmania University, Hyderabad.
11. Panchabhaye, P.M. (1997): Mutation breeding of sunflower (*Helianthus annuus* L.) Ph.D.Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, India.
12. Routaray, B.N., Mishra R.G.and Das S.N. (1995): Genetic variability and effectiveness of some chemical mutagens on black gram in relation to resistance source against *Meloidogyne incognita*. *Curr. Agri. Res*. 8: 3-4.
13. Rayyan, Asra (1995): Mutagenesis and tissue culture studies in *Vigna mungo* (L,) Hepper., Ph.D. Thesis, Osmania University, Hyderabad.
14. Siag, R.K., Gau R.B., Singh V., Vijay Prakash, Verma R.S. (2005): Studies on technology transfer through front line demonstration on mungbean semi-arid region of Rajasthan. *Indian Journal of Pulses Research* 18 (1), 64-66.
15. Sagade, (2008): Genetic improvement of urdbean (*Vigna mungo* L. Hepper) through mutation breeding. Ph.D. Thesis, University of Pune, India.
16. Swaminathan, M.S. (1963): Evaluation of the use of induced micro and macro mutations in the breeding of polyploidy plants. *Proc. Symp. Appl. Nuclear Energy Agric. Rome,* 1961: 243-277.
17. Scossirolli, R.E., Palenzona D.L. and Scossirolli Pellegrini, S. (1966): Studies on induction of new genetic variability for quantitative traits by seed irradiation and its use for wheat improvement. Mutations in Plant Breeding. IAEA Vienna, pp197-229.

How to cite this article:

Sonavane A.S.2017, Effect of Sodium Azide on Yield Parameters of Winged Bean [Psophocarpus Tetragonolobus (L.) DC.]. *Int J Recent Sci Res.* 8(12), pp. 22546-22549. DOI: http://dx.doi.org/10.24327/ijrsr.2017.0812.1287

****